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WE CLAIM:

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A porous structured aluminosilicate composition which comprises:

5 a framework of linked tetrahedral SiO_4 and AlO_4 units, the framework defining pores and having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak corresponding to a basal spacing between about 2 and 100
10 nm, and wherein the composition retains at least 50% of an initial framework pore volume after exposure to 20 volume % steam at 800°C for two hours.

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A porous structured aluminosilicate composition which comprises:

a framework of linked SiO_4 and AlO_4 units, the framework defining pores and having a Si to Al molar ratio of about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak between 2 and 100 nm, and wherein the composition retains at least 75% of an initial framework pore volume after exposure to 20 volume percent steam at 600°C for four hours.

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The composition of Claims 1 or 2 assembled from preformed zeolite seeds.

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The composition of Claims 1 or 2 having a BET surface area of between about 200 and 1400 m² per gram, an average pore size between about 1 and 100 nm and a pore volume of between about 0.1 and 3.5 cm³ per gram.

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The composition of Claim 3 wherein the zeolite seeds are formed using a structure director selected from the group consisting of organic onium ions, alkali metal ions and mixtures thereof.

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A porous structured aluminosilicate composition which comprises:

5 a framework of linked tetrahedral SiO₄ and AlO₄ units, the framework defining pores having an organic surfactant in the pores and having a Si to Al molar ratio of between 1000 to 1 and 1 to 1 and having at least one X-ray diffraction peak corresponding to a basal spacing between about 2 and 100 nm and wherein the composition is derived from an organic surfactant, an
10 optional co-surfactant, and preformed zeolite seeds.

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The composition of Claim 6 wherein the organic surfactant is selected from the group consisting of an organic onium ion surfactant and a non-ionic surfactant.

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The composition of Claim 7 wherein the surfactant is a non-ionic surfactant selected from the group consisting of a non-ionic polyethylene oxide surfactant and a non-ionic amine surfactant.

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The composition of Claim 6 wherein the zeolite seeds are formed using a structure director selected from the group consisting of organic onium ions, alkali metal ions and mixtures thereof.

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The composition of Claim 1, 2 or 3 containing between about 0.1 and 10% by weight carbon in the framework pores.

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The composition of Claims 1 and 2 with an infrared absorption band between 500 and 600 cm^{-1} .

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5 The composition of Claim 6 wherein the organic surfactant contains a co-surfactant selected from the group consisting of alkyl alcohol, alkyl amine, aromatic hydrocarbon and mixtures thereof containing between about 2 and 36 carbon atoms in the alkyl and 6 to 36 carbon atoms in the aromatic hydrocarbon.

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A process for forming a porous aluminosilicate composition which comprises:

5 (a) providing protozeolitic aluminosilicate seeds selected from the group consisting of an aqueous solution, gel, suspension wetted powder and mixtures thereof;

(b) reacting in a mixture the seeds in an aqueous medium with an organic surfactant;

10 (c) aging the mixture of step (b) at a temperature between 25° and 200°C to obtain a precipitate of the composition; and

(d) separating the composition from the mixture of step (c).

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The process of Claim 13 wherein the seeds are zeolite seeds.

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The process of Claims 13 or 14 wherein the organic surfactant is selected from the group consisting of onium ion surfactants and non-ionic surfactants.

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The process of Claim 15 wherein the organic surfactant contains a co-surfactant selected from the group consisting of alkyl alcohol, alkylamine, aromatic hydrocarbon and mixtures thereof containing between about 2 and 36 carbon atoms in the alkyl and 6 to 36

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carbon atoms in the aromatic hydrocarbon.

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The process of Claim 14 wherein the zeolite seeds are formed using a structure director selected from the group consisting of organic onium ions, alkali metal ions and mixtures thereof.

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The process of Claims 13 or 14 wherein in addition the composition is calcined.

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The process of any one of Claims 13, 14 or 17 wherein in addition the composition is calcined at above about 400°C.

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A structured aluminosilicate composition which comprises:

5 a framework of linked tetrahedral SiO_4 and AlO_4 units, the framework defining mesopores having an surfactant and optionally a co-surfactant in the mesopores, having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak corresponding to a basal spacing between about 2.0 and 100 nm, and which when calcined
10 retains at least 50% of an initial framework pore volume after exposure to 20 volume % steam at 800°C for two hours.

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The composition of Claim 20 wherein the surfactant is selected from the group consisting of:

(a) an ammonium or phosphonium ion of the formula $\text{R}_1\text{R}_2\text{R}_3\text{R}_4\text{Q}^+$, wherein Q is nitrogen or phosphorous,
5 and wherein at least one of the R moieties is selected from the group consisting of aryl, alkyl of between about 6 to 36 carbon atoms and combinations thereof, remaining of the R moieties are selected from the group consisting of hydrogen, alkyl of from 1 to 5 carbon
10 atoms and combinations thereof, and

(b) a non-ionic block surfactant containing polyethylene oxide units in a hydrophilic block and polypropylene oxide, polybutylene oxide, alkyl, or aryl units in a hydrophobic block, and nonionic amine
15 surfactants containing 6 to 36 carbon atoms.

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5 The composition of Claim 20 wherein there is the co-surfactant which is selected from the group alkyl amine, alkyl alcohol, aromatic hydrocarbon and mixtures thereof, wherein the number of carbon atoms in the co-surfactant is between 2 and 36.

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 The composition of any one of Claims 1, 2, 6 or 20 wherein the framework has a structure which is hexagonal, cubic, lamellar, wormhole or cellular foam.

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 The composition of Claims 6 or 20 wherein the onium ion surfactant and optional co-surfactant is removed by calcination, by ion exchange, or by a combination of ion exchange and calcination.

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5 A porous aluminosilicate composition which comprises: a framework of tetrahedral linked SiO_4 and AlO_4 units, the framework defining mesopores having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak corresponding to a basal spacing between about 2.0 and 100 nm, wherein a BET surface area is between 200 and 1400 m^2 per gram, wherein an average pore size of the framework is between about 1.0 and 100 nm, and wherein
10 a pore volume of the framework is between about 0.1 and 3.5 cm^3 per gram, and which retains at least 50% of an initial framework pore volume after exposure to 20 volume % steam at 800°C for two hours.

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The composition of Claim 25 wherein the framework has a structure which is hexagonal, cubic, lamellar, wormhole, or cellular foam.

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5 A hybrid porous aluminosilicate - carbon
composition which comprises: a framework of linked
tetrahedral SiO_4 and AlO_4 units, the framework defining
mesopores having an Si to Al molar ratio of between
10 about 1000 to 1 and 1 to 1 and between 0.01 and 10 wt%
carbon embedded in the mesopores, and having at least
one X-ray diffraction peak corresponding to a basal
spacing between about 2.0 and 100 nm, wherein a BET
surface area is between 200 and 1400 m^2 per gram,
15 wherein an average pore size of the framework is between
about 1.0 and 100 nm, and wherein a pore volume of the
framework is between about 0.1 and 3.5 cm^3 per gram, and
which retains at least 50% of an initial framework pore
volume after exposure to 20 volume % steam at 800°C for
15 two hours.

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The composition of Claim 27 wherein the
framework has a structure which is hexagonal, cubic,
lamellar, wormhole, or cellular foam.

A composition prepared by treating the composition of Claim 20 with an ammonium salt solution at a temperature between about 0° and 200°C for a period of up to 24 hours and repeating the treatment up to ten times to introduce ammonium ions into the composition, collecting and drying the resulting composition, and then calcining the resulting composition at a temperature between about 400 and 900°C to remove the surfactant and to convert a fraction of the surfactant to carbon embedded in the mesopores.

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A process for forming the mesoporous aluminosilicate composition which comprises:

5 (a) reacting a sodium silicate solution at basic pH with a sodium aluminate solution at an aluminum to silicon ratio between about 1000 to 1 and 1 to 1 and aging the mixture at 25 to 200°C for periods of up to 48 hours to form zeolite seeds;

(b) reacting the resultant mixture with a surfactant and optionally a co-surfactant;

10 (c) acidifying the mixture obtained from (b) with a protonic acid to obtain a mixture with an OH^- / (Si+Al) ratio in the range of 0.10 to 10;

(d) aging the mixture from step (c) at a temperature between 20 and 200°C to obtain a precipitate;
15 of the composition; and

(e) separating the composition from mixture of step (d).

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The process of Claim 30 wherein the sodium silicate is prepared by reacting sodium hydroxide with a silicon source selected from the group consisting of
5 a colloidal silica, a fumed silica, a silica gel, a silicon alkoxide and mixtures thereof.

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5 The process of Claim 30 wherein the sodium aluminate is prepared by reacting sodium hydroxide with an aluminum source selected from the group consisting of a soluble aluminum salt, a cationic aluminum oligomers, an aluminum hydroxide, an aluminum oxide, an aluminum alkoxide and mixtures thereof.

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 The process of Claim 30 wherein the surfactant is selected from the group comprising:

 (a) a alkyl quaternary ammonium surfactant with a hydrophobic segment which contains between 8 to 36 carbon atoms,

 (b) a non-ionic surfactant containing a polyethylene oxide block as a hydrophilic segment, and

 (c) a non-ionic amine surfactant.

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 The process of Claim 30 wherein the composition has a ^{27}Al -NMR resonance line exhibiting a chemical shift in the range of 57 to 65 ppm relative to an external reference of 1.0 M aluminum nitrate.

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A process for forming the mesoporous aluminosilicate composition which comprises:

5 (a) providing zeolite seeds as an aqueous solution, gel, suspension, wet powder, or combination thereof;

(b) reacting the zeolite seeds in the aqueous medium with a surfactant wherein the solution has an $\text{OH}^-/(\text{Si}+\text{Al})$ ratio in the range of 0.10 to 10;

10 (c) aging the mixture from step (b) at a temperature between 20 and 200°C to obtain a precipitate of the composition; and

(d) separating the composition from the mixture of step (c).

A catalyst useful for a fluidized bed catalytic cracking (FCC) or hydrocracking of an organic molecule which comprises:

5 (a) a mesoporous aluminosilicate composition which comprises a framework of linked tetrahedral SiO_4 and AlO_4 units, the framework defining mesopores having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak corresponding to a basal spacing between about 2.0 nm
10 and 100nm, wherein a BET surface area is between 200 and 1400 m^2 per gram, wherein an average pore size of the framework is between about 1.0 and 100 nm, and wherein a pore volume of the framework is between about 0.1 and 3.5 cm^3 per gram, and which retains at least 50% of an
15 initial framework pore volume after exposure to 20 volume % steam at 800°C for two hours; and

(b) a binder for the aluminosilicate composition.

A catalyst useful for fluidized bed catalytic cracking (FCC) or hydrocracking of an organic molecule which comprises:

- 5 (a) a mesoporous aluminosilicate - carbon composition which comprises a framework of linked tetrahedral SiO_4 and AlO_4 units, the framework defining mesopores having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1 and between 0.01 and 10 wt% carbon embedded in the mesopores, and having at least
- 10 one X-ray diffraction peak corresponding to a basal spacing between about 2.0 and 100 nm, wherein a BET surface area is between 200 and 1400 m^2 per gram, wherein an average pore size of the framework is between about 1.0 and 100 nm, and wherein a pore volume of the
- 15 framework is between about 0.1 and 3.5 cm^3 per gram, wherein the carbon content is between 0.01 and 10% by weight, and which retains at least 50% of an initial framework pore volume after exposure to 20 volume % steam at 800°C for two hours; and
- 20 (b) a binder for the aluminosilicate-carbon composition.

A process for catalytic reaction of an organic molecule into lower molecular weight components, which comprises:

- 5 (a) providing in a reactor a catalytic cracking catalyst which comprises: a mesoporous aluminosilicate composition which comprises a framework of linked tetrahedral SiO_4 and AlO_4 units, the framework defining mesopores having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least
- 10 one X-ray diffraction peak corresponding to a basal spacing between about 2.0 and 100 nm, wherein a BET surface area is between 200 and 1400 m^2 per gram, wherein an average pore size of the framework is between about 1.0 and 100 nm, and wherein a pore volume of the
- 15 framework is between about 0.1 and 3.5 cm^3 per gram; and a binder for the aluminosilicate composition, and which retains at least 50% of an initial framework pore volume after exposure to 20 volume % steam at 800°C for two hours; and
- 20 (b) introducing the organic molecule onto the catalyst at temperatures and pressures which cause the reaction of the organic molecule.

A process for reaction of an organic molecule into lower molecular weight components, which comprises:

- 5 (a) providing in a reactor a catalytic cracking catalyst which comprises: a mesoporous aluminosilicate - carbon composition which comprises: a framework of tetrahedral linked SiO_4 and AlO_4 units, the framework defining mesopores having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1 and between 0.01 and 10 wt% carbon embedded in the mesopores, and
- 10 having at least one X-ray diffraction peak corresponding to a basal spacing between about 2.0 and 100 nm, wherein a BET surface area is between 200 and 1400 m^2 per gram, wherein an average pore size of the framework is between about 1.0 and 100 nm, and wherein a pore
- 15 volume of the framework is between about 0.1 and 3.5 cm^3 per gram; and a binder for the aluminosilicate-carbon composition, and which retains at least 50% of an initial framework pore volume after exposure to 20 volume % steam at 800°C for two hours; and
- 20 (b) introducing the organic molecule onto the catalyst at temperatures and pressures which cause the reaction of the organic molecule.

A catalyst useful for a fluidized bed catalytic cracking (FCC) or hydrocracking of an organic molecule which comprises:

5 (a) a porous structured aluminosilicate composition which comprises:

10 a framework of linked tetrahedral SiO_4 and AlO_4 units, the framework defining pores and having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak corresponding to a basal spacing between about 2 and 100 nm, and wherein the composition retains at least 50% of the initial framework pore volume after exposure to 20 volume % steam at 800°C for two hours; and

15 (b) a binder for the aluminosilicate composition.

A process for reaction of an organic molecule into lower molecular weight components which comprises:

(a) providing a porous structured aluminosilicate composition which comprises:

5 a framework of linked tetrahedral SiO_4 and AlO_4 units, the framework defining pores and having an Si to Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak corresponding to a basal spacing between about 1 and 100
10 nm, and wherein the composition retains 50% of the initial framework pore volume upon exposure to 20 volume percent steam at 800°C for two hours; and

(b) introducing the organic molecule onto the catalyst at temperatures and pressures which cause the
15 reaction of the organic molecule.

In a catalyzed organic reaction, the improvement which comprises:

conducting the reaction with a catalyst which is selected from the group consisting of a porous structured aluminosilicate, gallosilicate, titanosilicate and mixtures thereof which catalyst comprises: a framework of linked tetrahedral SiO_4 and AlO_4 , GaO_4 or TiO_4 units, the framework defining pores and having an Si to combined Ga, Ti and Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak corresponding to a basal spacing between about 2 and 100 nm, and wherein the composition retains at least 50% of initial framework pore volume after exposure to 20 volume % steam at 600°C for four hours.

A porous structured silicate composition which comprises:

a framework of linked tetrahedral SiO_4 and units selected from the group consisting of AlO_4 units, GaO_4 units, TiO_4 units and mixed units, the framework defining pores and having an Si to combined Ga, Ti and Al molar ratio of between about 1000 to 1 and 1 to 1, and having at least one X-ray diffraction peak corresponding to a basal spacing between about 1 and 100 nm, and wherein the composition retains at least 50% of the initial framework pore volume after exposure to 20 volume percent steam at 600°C for four hours.

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The composition of Claim 43 assembled from preformed nanoclustered seed precursors.

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5 The composition of Claims 43 or 44 having an X-ray diffraction peak corresponding to a basal spacing between about 2 and 100 nm, a BET surface area of between about 200 and 1400 m² per gram, an average pore size between about 1 and 100 nm and a pore volume of between about 0.1 and 3.5 cm³ per gram.

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The composition of Claim 44 wherein the seed precursors are formed using a structure director selected from the group consisting of organic onium ions, alkali metal ions and mixtures thereof.

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The composition of Claims 1 and 2 with a ²⁷Al NMR chemical shift between about 57 and 65 ppm relative to an external reference of 1.0 M aluminum nitrate.